

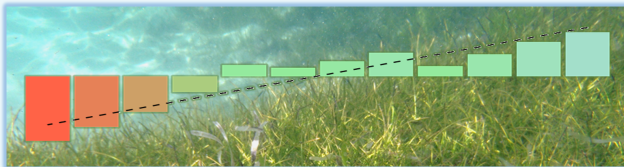
SWMPPr: An R package for estuarine water quality time series

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April 15, 2015



A mixture of things...

- What is NERSS/SWMP and motivation for creating the package
- The process of package development
- What can SWMP_r do
- What has SWMP_r done

What is NERRS/SWMP?

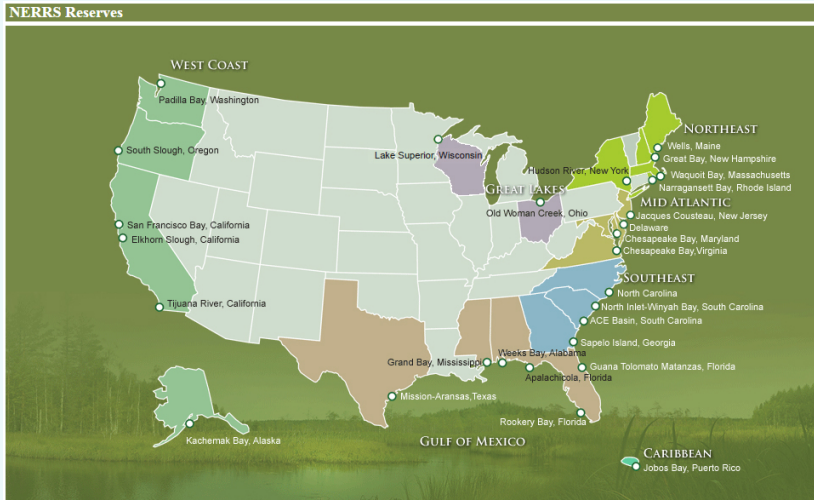
NERRS

National Estuarine Research Reserve System, established by Coastal Zone Management Act of 1972. Address goals for *long-term research, monitoring, education*, and *stewardship* for more effective coastal management.

SWMP

System Wide Monitoring Program, initiated in 1995 to provide *continuous monitoring* data at over 300 stations in in each of the 28 NERRS reserves

What is NERRS/SWMP?



<http://nerrs.noaa.gov/ReservesMap.aspx>

What is NERRS/SWMP?

Each reserve has fixed, continuous monitoring stations for ***water quality*** (15 min), ***meteorology*** (15 min), and ***nutrients*** (monthly)

The parameters for a station are specific to the parameter type

Water quality

temp, spcond, sal,
do_pct, do_mgl,
depth, cdepth, level,
clevel, ph, turb,
chlfluor

Meteorology

atemp, rh, bp, wspd,
maxwspd, wdir,
sdwdir, totpar,
totprcp, cumprcp,
totsorad

Nutrients

po4f, chla_n, no3f,
no2f, nh4f, no23f,
ke_n, urea

What is NERRS/SWMP?

Data maintained by the Centralized Data Management Office (CDMO)

Home	About CDMO	About Data	Get Data	Web Services	Contact CDMO
					
View / Download Data		Real Time Monitoring Data		CDMO News	
 <p>Requested Citation Format</p>		<div>Choose Reserve... ▾</div> <p>GTMPMET 10/08/14 09:45 AM GTMPCWQ 10/08/14 09:45 AM</p>  <p>Air Temperature: 27.8 °C (82 °F) Wind Speed: 1.1 m/Sec (02 mph) Water Temperature: 22.7 °C (73 °F) Salinity: 7.1 PPT Dissolved Oxygen: 4.7 mg/L</p>		<p>The CDMO is excited to announce the launch of our new SWMP Mobile application. Near real-time SWMP data is now available on your smartphone or tablet at: www.nerrsdata.org/mobile</p> <hr/> <p>Our Data Export System has been updated and now has enhanced graphing capabilities! Want to easily export or graph data? If so, check out our Data Export System</p>	

What is NERRS/SWMP?

As of April 10, > 58 million SWMP data records available from CDMO

Raw data will look like this...

	A	B	C	D	E	F	G	H	I	J	K	L
1	StationCo	isSWMP	DateTimeStamp	Historical	Provisional	CollMeth	REP	F_Record	PO4F	F_PO4F	NH4F	F_NH4F
2	apacpnut	P	1/10/2012 10:20	0	1	1	1		0.003	<-4> [SBL]	0.03	<0>
3	apacpnut	P	2/7/2012 11:41	0	1	1	1		0.005	<0>	0.019	<0>
4	apacpnut	P	3/5/2012 11:51	0	1	1	1		0.003	<-4> [SBL]	0.041	<0>
5	apacpnut	P	4/4/2012 10:30	0	1	1	1		0.003	<-4> [SBL]	0.043	<0>
6	apacpnut	P	5/9/2012 10:12	0	1	1	1		0.003	<0>	0.053	<0>
7	apacpnut	P	5/9/2012 10:15	0	1	1	2		0.003	<-4> [SBL]	0.022	<0>
8	apacpnut	P	5/9/2012 10:20	0	1	1	3		0.003	<0>	0.016	<0>
9	apacpnut	P	6/5/2012 8:30	0	1	1	1		0.003	<-4> [SBL]	0.04	<0>
10	apacpnut	P	7/3/2012 9:58	0	1	1	1 {CSM}		0.004	<0>	0.094	<0>
11	apacpnut	P	7/3/2012 9:59	0	1	1	2 {CSM}		0.004	<0>	0.066	<0>
12	apacpnut	P	7/3/2012 10:01	0	1	1	3 {CSM}		0.005	<0>	0.069	<0>
13	apacpnut	P	8/7/2012 9:53	0	1	1	1 {CSM}		0.003	<-4> [SBL]	0.05	<0>
14	apacpnut	P	9/5/2012 10:56	0	1	1	1		0.003	<-4> [SBL]	0.026	<0>
15	apacpnut	P	10/2/2012 9:22	0	1	1	1		0.003	<-4> [SBL]	0.042	<0>
16	apacpnut	P	10/2/2012 9:27	0	1	1	2		0.003	<-4> [SBL]	0.024	<0>
17	apacpnut	P	10/2/2012 9:32	0	1	1	3		0.003	<0>	0.042	<0>
18	apacpnut	P	11/6/2012 10:30	0	1	1	1		0.003	<-4> [SBL]	0.07	<0>
19	apacpnut	P	11/26/2012 11:39	0	1	1	1		0.003	<-4> [SBL]	0.041	<0>

What is the problem?

An invaluable data source but no recent comparative analyses between systems

NERRS researchers, managers, and technicians need more tools for trend analysis

Some specific issues:

- Knowing what data to use and how to obtain
- Dealing with QAQC columns or removing ‘bad’ observations
- Combining data for comparison
- Issues inherent with time series, e.g., signal vs. noise, data quantity

What is the (potential) solution?



SWMP_r v2.0.0 is now available on CRAN!

```
> install.packages('SWMP_r')  
> library(SWMP_r)
```

Currently no vignette, but working on a manuscript

The process of package development

The development version lives on GitHub:

https://github.com/fawda123/SWMP_r

The package development process was much simplified using RStudio and the Hadleyverse (specifically `devtools`, `roxygen2`)

In RStudio, create a package template:

File > New Project > New Directory > R Package, with options for Git version control

Package does not have to be on CRAN to distribute...

The process of package development

Follow the advice here: <http://r-pkgs.had.co.nz/>

R packages by Hadley Wickham

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I'm next teaching in [Chicago, May 27-28](#).

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How to contribute

Edit this page

R packages

This is the in-progress book site for “**R packages**”. It will be published with O'Reilly around March 2015. You can [pre-order](#) a copy from amazon.



Packages are the fundamental units of reproducible R code. They include reusable R functions, the documentation that describes how to use them, and sample data. In this section you'll learn how to turn your code into packages that others can easily download and use. Writing a package can seem overwhelming at first. So start with the basics and improve it over time. It doesn't matter if your first version isn't perfect as long as the next version is better.

Getting started

- [Introduction](#)
- [Package structure](#)

What can SWMP_r do?

SWMP_r functions are grouped into three categories that describe their use in the ‘data workflow’

Retrieve

all_params
all_params_dtrng
import_local
import_remote
single_param
site_codes
site_codes_ind

Organize

comb
qaqc
qaqcchk
rem_reps
setstep
subset

Analyze

aggreswmp
aggremetab
ecometab
decomp
decomp_cj
hist
lines
na.approx
plot
plot_metab
plot_summary
smoother

How are data *retrieved*?

The first challenge is to determine the station, parameter, and date range of interest - Check the available data on the CDMO website

Also familiarize yourself with the NERRS/SWMP naming convention

Site (reserve), ***station***, and ***parameter type*** are identified by a 7 or 8 character name

E.g., elkcwmet

- elk: site, Elkhorn Slough
- cw: station, Caspian Weather Station
- met: parameter type (weather)

How are data *retrieved*?

SWMP data can be imported from CDMO into R three ways

1) From a local path: `import_local`

Advantages:

- Ideal for large datasets
- Most recent data

Disadvantages:

- Outside of R
- Only works for one type of data request from CDMO

How are data *retrieved*?

SWMP data can be imported from CDMO into R three ways

2) retrieve SWMP data from a third-party server: `import_remote`,

Advantages:

- Fast import!
- No requests to CDMO

Disadvantages:

- Data are not current
- Requires further processing - date subsets, etc.

How are data *retrieved*?

SWMP data can be imported from CDMO into R three ways

3) Use the existing CDMO web services to import directly:
`single_param`, `all_params`, `all_params_dtrng`

Advantages:

- Current
- Customized requests

Disadvantages:

- IP address must be registered
- Quantity severely limited

How are data *retrieved*?

The best approach depends on your needs

The end result is the same - data are imported as a `swmpr` S3 object

```
> dat <- import_remote('kacsswq')  
> class(dat)
```

```
## [1] "swmpr"          "data.frame"
```

```
> names(attributes(dat))
```

```
## [1] "names"          "row.names"      "class"          "station"  
## [5] "parameters"     "qaqc_cols"      "date_rng"       "timezone"  
## [9] "stamp_class"
```

How are data *retrieved*?

The remaining functions have **swmpr** methods

```
> methods(class = 'swmpr')  
  
## [1] aggregemtab.swmpr*   aggreswmp.swmpr*  
## [3] comb.swmpr*          decomp.swmpr*  
## [5] decomp_cj.swmpr*     ecometab.swmpr*  
## [7] hist.swmpr*          lines.swmpr*  
## [9] na.approx.swmpr*     plot.swmpr*  
## [11] plot_metab.swmpr*    plot_summary.swmpr*  
## [13] qaqc.swmpr*          qaqcchk.swmpr*  
## [15] rem_reps.swmpr*      setstep.swmpr*  
## [17] smoother.swmpr*      subset.swmpr*  
##  
##      Non-visible functions are asterisked
```

swmpr objects also inherit methods from the **data.frame** class

How are data *organized*?

test